

CLAIMS

What is claimed is:

1 1. A method to determine configuration information associated with an
2 optical network having a plurality of optical nodes coupled by optical fiber spans, the
3 method comprising:
4 discovering at least one neighboring optical node, each neighboring optical
5 node being coupled by a single optical span having at least one optical fiber;
6 each node publishing at least one neighboring node to the network; and
7 determining a network configuration having a topological map of network
8 links corresponding to the discovered neighboring optical nodes.

1 2. The method of claim 1, further comprising:
2 generating an alarm signal indicative of a network configuration error
3 responsive to detecting an error between the network configuration and a provisioned
4 configuration.

1 3. The method of claim 1, wherein each node determines a network
2 configuration from the published information that it receives.

1 4. The method of claim 3, further comprising: correlating information from
2 each node to isolate the location of a configuration error.

1 5. The method of claim 1, wherein discovering at least one neighboring
2 optical node comprises:

3 each node receiving node identification messages from adjacent nodes that
4 includes a unique source node identifier.

1 6. The method of claim 1, further comprising: each node publishing at least
2 one node configuration attribute to the network.

1 7. The method of claim 6, further comprising:
2 each node forming an information model of the optical network; and
3 each node determining a network configuration having an arrangement of
4 neighboring nodes consistent with the information model of the node.

1 8. The method of claim 7, wherein:
2 each node generates an alarm signal indicative of a network configuration
3 error responsive to the node detecting an error in the network configuration.

1 9. The method of claim 8, further comprising:
2 correlating the alarm signals of the nodes to isolate a location of a
3 configuration error.

1 10. The method of claim 1, further comprising:
2 forming an information model of the optical network which includes at least
3 one node configuration attribute for each node; and
4 determining a network configuration having an arrangement of neighboring
5 nodes consistent with the information model.

1 11. The method of claim 10, further comprising: responsive to determining
2 that the network configuration differs from a planned configuration, issuing an error
3 correction command to adapt the response of at least one node to form a compatible
4 network configuration.

1 12. The method of claim 10, wherein the information model includes the
2 identity of each span interface coupling neighboring nodes.

1 13. The method of claim 2, wherein the error is a fiber misconnection error
2 and an alarm signal is issued responsive to determining incorrectly connected optical
3 fibers.

1 14. The method of claim 2, wherein the error is that at least one node is of an
2 incompatible node type, and an incompatible node type alarm signal is issued responsive
3 to determining that at least one node is of an incompatible node type.

1 15. The method of claim 2, wherein the error is that at least one node has an
2 incompatible node setting and an incompatible node setting alarm signal is issued
3 responsive to determining that the at least one node has an incompatible node setting.

1 16. The method of claim 2, wherein the error is that at least one node has a
2 parameter associated with the node that is incompatible with the network design and an
3 out-of-bound node parameter alarm signal is issued responsive to determining that the at
4 least one node has an out-of-bound node parameter that is incompatible with the planned
5 configuration.

1 17. A method to determine a configuration error in an optical network having
2 a plurality of optical nodes coupled by optical fiber spans, the method comprising:

3 discovering at least one pair of neighboring optical nodes, each pair of
4 neighboring optical nodes being coupled by a single optical span having at least one
5 optical fiber;

6 determining a network configuration having a topological map of network
7 links corresponding to the discovered neighboring optical nodes; and

8 generating an alarm signal indicative of a network configuration error
9 responsive to detecting an error between the network configuration and a provisioned
10 configuration.

1 18. The method of claim 17, wherein discovering pairs of neighboring optical
2 nodes comprises:

3 each node receiving node identification messages from adjacent nodes that
4 includes a unique source node identifier; and

5 each node publishing its neighboring nodes to the network.

1 19. The method of claim 18, further comprising: each node publishing at
2 least one node configuration attribute to the network.

1 20. The method of claim 19, further comprising:

2 each node forming an information model of the optical network; and

3 each node determining a network configuration having an arrangement of
4 neighboring nodes consistent with the information model of the node.

1 21. The method of claim 20, wherein:

2 each node generates an alarm signal indicative of a network configuration
3 error responsive to the node detecting an error in the network configuration.

1 22. The method of claim 21, further comprising:

2 correlating the alarm signals of the nodes to isolate a location of a
3 configuration error.

1 23. The method of claim 17, further comprising:

2 forming an information model of the optical network that includes at least one
3 node configuration attribute for each node; and

4 determining a network configuration having an arrangement of neighboring
5 nodes consistent with the information model.

1 24. The method of claim 23, wherein the information model includes the
2 identity of each span interface coupling neighboring nodes.

1 25. The method of claim 24, wherein the error is a fiber misconnection error
2 and an alarm signal is issued responsive to determining incorrectly connected optical
3 fibers.

1 26. The method of claim 23, wherein the error is that at least one node is of
2 an incompatible node type, and an incompatible node type alarm signal is issued
3 responsive to determining that at least one node is of an incompatible node type.

1 27. The method of claim 23, wherein the error is that at least one node has an
2 incompatible node setting and an incompatible node setting alarm signal is issued
3 responsive to determining that the at least one node has an incompatible node setting.

1 28. The method of claim 23, wherein the error is that at least one node has a
2 parameter associated with the node that is incompatible with the network design and an
3 out-of-bound node parameter alarm signal is issued responsive to determining that the at
4 least one node has an out-of-bound node parameter that is incompatible with the planned
5 configuration.

1 29. A method to determine configuration information associated with an
2 optical network having a plurality of optical nodes coupled by optical fiber spans, the
3 method comprising:

4 exchanging identification messages between neighboring nodes, each
5 identification message including a source node identifier and node configuration data;
6 for each node, publishing the identity of the node, the identity of its neighbors,
7 and the node configuration data associated with the node; and
8 determining a network configuration consistent with the published node
9 information.

1 30. The method of claim 29, further comprising:

2 generating an alarm signal indicative of a configuration error responsive to
3 detecting an error in the network configuration.

1 31. The method of claim 30, wherein the node configuration data includes the
2 node protection type and the alarm signal is an incompatible node protection type alarm
3 signal generated responsive to determining that a node is of an incompatible node
4 protection type.

1 32. The method of claim 30, wherein the node configuration data includes a
2 node setting and the alarm signal is an incompatible node setting alarm signal generated
3 responsive to determining that a node has an incompatible node setting.

1 33. The method of claim 30, wherein the node configuration data includes a
2 node parameter associated with the network configuration and the alarm signal is an
3 incompatible node parameter alarm signal generated responsive to determining that at
4 least one node has an incompatible node parameter.

1 34. The method of claim 30, wherein the nodes publish information sufficient
2 to determine the span interfaces by which they are coupled to neighboring nodes and the
3 alarm signal is an incorrect fiber connection alarm signal generated responsive to
4 determining that at least one node has incorrectly connected fibers.

1 35. The method of claim 29, further comprising: responsive to determining
2 that the network configuration differs from a planned configuration, issuing an error
3 correction command to adapt the response of at least one node to form a compatible
4 network configuration.

1 36. An optical node for a optical network, comprising:
2 an optical transport complex for adding, dropping, and passing through optical
3 channels;

4 an administrative complex for administering the optical transport complex and
5 having a memory adapted to receive provisioning data for the optical transport complex;
6 an inter-node communication module coupled to the administrative complex
7 for communicating with neighboring nodes on an inter-node data channel and publishing
8 data to the optical network; and
9 a configuration discovery module exchanging node identification and
10 configuration data with other nodes to determine the network configuration.

1 37. The optical node of claim 36, wherein the configuration discovery module
2 further comprises:

3 a neighbor discovery and publication module to exchange node
4 identification messages with neighboring nodes and publish neighbor information to the
5 optical network;

6 a configuration analysis module forming an information model of the optical
7 network consistent with the node relationships of the neighbor information; and

8 an alarm generator comparing the information model with the provisioning
9 data and generating a configuration alarm responsive to detecting an error in the network
10 configuration.

1 38. The optical node of claim 37, wherein the configuration discovery module
2 includes node configuration data comprising a node identifier and at least one network
3 attribute associated with the node.

1 39. The optical node of claim 36, wherein the configuration discovery module
2 issues an alarm signal responsive to detecting a configuration error.

1 40. An optical network, comprising:

2 a plurality of optical nodes, each node having at least one neighbor node
3 which is coupled to it by an optical span;
4 each node having an inter-node communication module to communicate with
5 the other nodes of the network;
6 each node configured to identify itself to its neighbors and to publish the
7 identity of its neighbors to the optical network; and
8 at least one of the nodes configured to form a model of the network
9 configuration from published neighbor information.

1 41. The network of claim 40, wherein at least one of the nodes is configured
2 to issue an alarm signal responsive to the network configuration being different from a
3 provisioned network configuration.

1 42. The network of claim 40, wherein each node publishes a node identifier
2 and at least one node attribute to its neighbors and the model of the network includes the
3 at least one node attribute.

1 43. The network of claim 42, where at least one of the nodes is configured to
2 issue an alarm responsive to the network configuration being different from a provisioned
3 network configuration.

1 44. The network of claim 43, wherein the alarm is an incompatible node
2 protection type alarm responsive to detecting a node of an incorrect protection type.

1 45. The network of claim 43, wherein the alarm is an incompatible node
2 setting alarm responsive to detecting a node having an incompatible node setting.

1 46. The network of claim 43, wherein the alarm is an incompatible node
2 parameter alarm responsive to detecting a node having an incompatible node parameter.

1 47. The network of claim 40, wherein each node includes:

2 an optical transport complex for adding, dropping, and passing through optical
3 channels; and

4 an administrative complex for administering the optical transport complex
5 and having a memory adapted to receive provisioning data for the optical transport
6 complex.

1 48. The network of claim 40, further comprising:

2 an element management system (EMS) coupled to receive the model of the
3 network configuration and issuing an error correction command responsive to
4 determining a network configuration error.

1 49. The network of claim 48, wherein the error correction command
2 comprises provisioning at least one of the nodes.

1 50. The network of claim 48, wherein the error correction command is an
2 instruction to alter a node component.

1 51. An optical network, comprising:

2 a plurality of optical nodes coupled by optical spans, each node including an
3 internode communications capability to communicate messages with neighboring nodes
4 and to publish information to the optical network;

5 neighbor discovery means for discovering the identity of neighboring nodes;

6 configuration analysis means for determining a configuration of the optical
7 network having a topology map corresponding to the neighboring nodes; and

8 alarm means for generating an alarm signal indicative of a configuration error.

1 52. The optical network of claim 51, wherein the neighbor discovery means
2 exchanges node identification messages between adjacent nodes and publishes neighbor
3 information to the network.

- 1 53. The optical network of claim 51, wherein each node further publishes at
- 2 least one additional node attribute to at least one other node.